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REMITTANCE AND POVERTY NEXUS IN BOTSWANA: A MULTIVARIABLE APPROACH

Mercy T. Musakwa¹ and Nicholas M. Odhiambo

Abstract

This study investigates the causal relationship between remittance and poverty in Botswana using time series data from 1980-2017. To improve the robustness of the results, two poverty proxies are used, namely: household consumption expenditure and infant mortality rate. Employing the autoregressive distributed lag approach (ARDL) to cointegration and ECM-based causality test, the findings of the study reveal a short-run and long-run bidirectional causal relationship between poverty and remittance when household consumption expenditure is used as a proxy for poverty. However, when poverty is measured by infant mortality rate, a unidirectional causal relationship is confirmed both in the long run and the short run from poverty to remittance. Employing the same proxy, remittance was found to have an indirect causal effect on poverty through real gross domestic product per capita. The study concludes that remittance inflows play an important role in driving poverty reduction in Botswana, irrespective of whether the level of poverty is measured by household consumption expenditure or by infant mortality rate.

Key Words: Remittance; poverty; household consumption expenditure; infant mortality rate; Botswana; ECM-based causality testing

JEL Classification: F24, I31.

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1. Introduction

Botswana, like most developing countries, was part of the Millennium Development Goals in 2000 (United Nations 'UN', 2000) and subsequent extension of the Sustainable Development Goals (United Nations, 2018). The overarching objective of these UN-spearheaded conventions is inclusive economic development, where no one is left out. This step taken by Botswana exhibits commitment to eradicating poverty through harnessing of resources from domestic and international sources. Among international resources, foreign direct investment took center stage with most developing countries relying on it for economic development and eradication of poverty. This resulted in government policies in developing countries more biased toward attracting foreign direct investment. The surge in remittance inflows in most developing countries has ignited much interest in the ability of remittance to boost economic growth and alleviate poverty. This consequently resulted in the Sustainable Development Goals (SDGs) including remittance as a goal to prosperity for all, among other crucial development goals. The importance of remittance inflows in economic development is captured by SGD 10.7 – reducing inequality within and among countries (United Nations, 2017). Although the United Nations acknowledge the importance of remittance inflows to economic development in general and in poverty reduction in particular, the paucity of the literature on the relationship between remittance and poverty reduction suggests the importance of another empirical study on Botswana.

The flow of remittance to developing countries has surged in the recent past and is forecast to reach \$528 million by 2018 (Ratha *et al.*, 2018). This is a remarkable growth of 10.8% from the previously recorded inflows in 2017 (Ratha *et al.*, 2018). Although remittance cannot substitute official development assistance and foreign direct investment, they have grown

three-fold compared to the former foreign capital resources in low- and middle-income countries when China is excluded (Ratha *et al.*, 2018). Given the steady increase in remittance inflows on the one hand, and the commitment by Botswana to implement alleviation of poverty among other commitments signed during the 2015 on Sustainable Development Goals (SDGs) on the other hand, another study on the relationship between remittance and poverty will assist policy makers in Botswana to come up with effective poverty alleviation strategies.

A deluge of literature is available on the impact of remittance on economic growth (see Goschin, 2014; Imai *et al.*, 2014; Lim and Simmons, 2015; Meyer and Shera, 2017; Makun, 2018). The same can also be said for the studies that explored the impact of remittance on poverty (see Adam Jr. and Page, 2005; Gupta *et al.*, 2009; Adam Jr. and Cuenquecha, 2013; Vacaflores, 2018; Wangle and Devkota, 2018). However, there is a dearth of literature on the causal relationship between remittance and poverty. Among the studies that explored the causality between remittance and poverty, the results are far from being conclusive (see, for example, Abdunnasser and Salah, 2014; Gaaliche and Gaaliche, 2014; Yasmin *et al.*, 2015; Muhammad *et al.*, 2016). The inconclusive results can be attributed to the methodology used, poverty measures employed and the domain used in the studies. This study will add value to the body of knowledge by shading some light on the direction of causality between remittance and poverty in Botswana. This will further inform policy makers on which variable to influence first to get the desired outcome on poverty alleviation and benefit from the increased remittance inflows.

The debate on the best proxy for poverty is still raging with most researchers advocating for a multidimensional measure of poverty – no agreement has yet been reached. In an effort to capture poverty in a multidimensional form, this study employs two proxies. The first proxy is household consumption expenditure, which measures income poverty and infant mortality rate which capture health poverty. Although there are other indexes that measure poverty in a multidimensional form such as the human development index, due to insufficient time series data the measure could not be used. The same applies to other income poverty measures such as poverty headcount, poverty gap and poverty gap squared. The selection of two poverty proxies improves the robustness of the results. Other studies have employed household consumption expenditure as a poverty proxies (see Ravallion, 2001; Rehman and Shahbaz; 2014) and infant mortality rate as proxies (see Reidpath, and Allotey, 2003; Van Multzahn and Durrheim; 2008; Abosedra *et al.*, 2016).

Although low-and middle-income countries have experienced a surge in remittance inflows, for Botswana the same has not been registered in the recent past. After gaining independence in 1966, Botswana was a marginalised country and most Batswana emigrated to work in gold and diamond mines in South Africa (Migration Policy Institute, 2004). This contributed greatly to high remittance inflows in the 80s averaging 4.2% until the 90s where the average declined to 1.2% and up to 2017 the share of remittance to GDP remained below 1% (UNCTAD, 2019). After the discovery of diamonds in Orapa, Botswana's fortunes turned, and to date the economy is highly stable and prosperous in the middle-income category, resulting in most Batswana preferring to work and stay in their own country (Migration Policy Institute, 2004). In the long-term Vision 2036, under Pillar 2 the policy makers envisage outward migration to alleviate high unemployment especially among the youth and internationally competitive

Batswana (Ministry of Finance and Economic Development, 2019:13). An empirical investigation on the causal relationship would add to the exploration of the advantages of remittance inflows to Botswana. Like South Africa, Botswana has remained a major source of outward remittance as most migrants are seeking greener pastures in these countries. Despite the depressed remittance inflows in Botswana due to a decline in emigration, the question that remains important is, in its fight against poverty, is Botswana recommended to put in place policies that support emigration and benefit from the remittance inflows like other low- and middle-income countries.

The rest of the study is organised as follows: Section 2 discusses the literature review; section 3 outlines estimation techniques; section 4 presents and discusses the results; and section 5 concludes the study.

2 Empirical Literature Review

2.1 Remittance and Poverty Dynamics in Botswana

Botswana entered into a number of conventions that support migration as early as 1945, before independence. Some of the conventions to which Botswana is a signatory which are also part of the United Nations (UN) legal instruments are: 1945 ILO Migration for Employment Convention, 1975 ILO Migrant Workers Convention, 1990 UN Migrant Workers Convention, 2002 Migrant Smuggling Protocol (United Nations Children's Emergency Funds 'UNICEF', 2019). The total number of emigrants as at 2017 was 80.1 thousand and the net migration for the past five years was at 15 thousand (Migration Policy Institute, 2019). The ability of the Botswana government to harness diamond resources and channel it towards development has

left most Batswana contented to work and stay in the home country (Migration Policy Institute, 2004). This is contrary to the early years after gaining independence where there was a proliferation of emigrants to South Africa among other destination countries to look for employment (Migration Policy Institute, 2004). Given the increase in remittance inflows in developing countries and the rising debate on whether remittance can reduce poverty, another investigation will shed some light on the nature of this relationship in Botswana.

Remittances were high in the 1980s when a fair number of Batswana were still providing their labor especially in the diamond and gold mines in South Africa. The highest remittance inflows as a percentage of GDP of 8% were recorded in 1980 (UNCTAD, 2019). Thereafter, there was a gradual fall in remittance inflows throughout the 1990s and 2000s (UNCTAD, 2019). The average remittance inflows registered between 1990 and 2000 was 1.4% (UNCTAD, 2019). This is 1% higher than the average of 0.4% recorded from 2000 to 2017 (UNCTAD, 2019). Contrary to the trend in remittance inflows that other developing countries are experiencing, Botswana is receiving thin inflows.

In Botswana, economic development and poverty alleviation policies, among other initiatives are guided by the long-term Vision 2036 (Ministry of Finance and Economic Development, 2019). The long-term vision consists of four pillars, with Pillar 1 – Sustainable development, Pillar 2 – Human and social development, and Pillar 3 – Sustainable Environment, encompassing key aspects in poverty alleviation. In line with the long-term vision, the short-term development plans are rolled out through National Development Plans (NDPs). The current National Development Plan 11 is a successor to NDP10 that strove to harness the

private sector into economic development and reduce dependency on government financial support. NDP 11 reinforces the NDP10 by providing opportunities for the poor to have sustainable livelihoods (Ministry of Finance and Economic Development, 2019: 28). Government poverty reduction policies can be grouped into three categories. First is economic development, inclusive growth, and economic empowerment; second is social inclusion in education, access to health, housing and economic opportunities; third is social protection and safety nets for those already trapped in poverty (Seleka *et al.*, 2007).

In response to government policy initiatives, there has been a gradual reduction in poverty when measured by metrics such as poverty headcount, poverty gap, human development index (HDI) and income held by the lowest 20% of the population (World Bank, 2019). Poverty headcount at the \$5.50 poverty line was at 82.6%, while poverty headcount at the \$1.90 poverty line was at 42.6% in 1985 (World Bank, 2019). The poverty headcount fell steadily to 60.4% and 16.1% in 2015 for \$5.50 and \$1.90 poverty lines respectively (World Bank, 2019). The same pattern can be seen with poverty depth where 29.4% was recorded in 2015 for the \$5.50 poverty line, a fall from 49.9% in 1985 (World Bank, 2019). The same trend was registered for the \$1.90 poverty line that registered 4.3% in 2015, a decline of 13.6% from the poverty gap recorded in 1985 (World Bank, 2019). The income held by the bottom 20% improved slightly over the period, with 3.9% income being held by the bottom 20%, a marginal improvement from 3.6% recorded in 1985 (World Bank, 2019). Thus, Botswana remains a highly unequal country, with the highest 20% taking 58.9% in 1985 and realising a slight fall of 0.04% in 2015 to register 58.5% (World Bank, 2019). The human development index (HDI) also reflects a considerable improvement from 0.58 registered in 1990 to 0.72 recorded in 2017 (United

Nations Development Programme ‘UNDP’, 2019). Although Botswana registered a fall in poverty, poverty levels vary across district, settlement type and sex (Statistics Botswana, 2013).

2.2 A Review of Related Literature

The surge in remittance inflows has resulted in many developing countries supporting emigration to benefit from the additional foreign resources not associated with interest or repayment. The Sustainable Development Goals, a successor to the Millennium Development Goals (MDGs), include remittance in section 10 (United Nations ‘UN’, 2018). This indicates the importance of remittance as an additional source of funding for poverty alleviation and economic development. According to International Organisation for Migration ‘IOM’ (2018), there are 244 million migrants - migrants comprise 3.3% of the world population. Migration within Africa has increased since 1990 and the number of Africans living outside the region has doubled (IOM, 2018).

There are a number of reasons, pointed out in the literature, why migrants would like to remit back home. Lucas and Stark (1985) identified altruism, savings and coinsurance as some of the factors that result in remittance inflows. The altruism motive rests on the need by migrants to help their struggling families back home; the savings motive is centred on the need by migrants to build savings back home in case income flow slows or they lose their jobs. The coinsurance motive is driven by a need to invest back home so that if anything happens to them while in the foreign country, they can return home and enjoy a better living standard. Remittance can be in the form of kind or cash that the migrant sends back home (Hagen-Zanker and Himmelstine, 2016).

In addition to altruism, savings and coinsurance, Adam Jr. and Page (2005) identified a positive role played by remittance in stimulating consumption. Ratha (2007) and De Vries (2011) also added investment in real estate, small business growth, improvement in the fiscal position of a country through the balance of payment as additional benefits that are associated with remittance. Besides the direct impact that remittance has on households, there is also a positive indirect impact of remittance on the economy realised through the multiplier effect – which could be from an increase in consumption and investment. Remittance flows have a multiplier effect that is felt at a national level. Further, remittances are a stable source of income for households as they have a countercyclical nature that is important during depressions, wars and natural disasters (Kapur, 2004).

Despite the benefits that are given in the theoretical literature, little has been done on the causal relationship between remittance and poverty, yet it is important to establish which variable between the two can be influenced to reduce poverty. Considerable literature has focused on the impact of remittance on poverty. The findings from these studies are divided between those that found a positive impact of remittance on poverty reduction (see Gupta *et al.*, 2009; Anyanwu and Erhijakpan, 2010; Tsaurai, 2018). Some studies found the relationship between remittance and poverty to be sensitive to the poverty measure used (Wangle and Devkota, 2018). Among the few studies that investigated the causal relationship between poverty and remittance, the studies are also divided between those that found a unidirectional causality (see for example Sanchez-Loor and Zambrano-Monserrate, 2015); some studies found bidirectional relationship between poverty and remittance (see Abdalnasser and Salah, 2014; Gaaliche and Gaaliche, 2014; Hatemi-j and Uddin, 2014; Sanchez-Loor and Zambrano-Monserrate, 2015;

Muhammad *et al.*, 2016) ; and some that found no causal relationship between remittance and poverty (Muhammad *et al.*, 2016; Sanchez-Loor and Zambrano-Monserrate, 2015).

Muhammad *et al.* (2016) investigated the causal relationship between remittance and poverty in 39 countries from low-middle, upper-middle and high-income countries employing data from 1990-2014. In the study, a unidirectional causal relationship was found from remittance to poverty in lower-middle and upper-middle countries. No causality was found in high-income countries in the same study.

Gaaliche and Gaaliche (2014) studied the causal relationship between remittances and poverty in 14 emerging and developing countries using data from 1980 to 2012. A bidirectional causal relationship was found between poverty and remittance. Abdunnasser and Salah (2014) also examined the causality between remittances and poverty in Bangladesh using data from 1976-2010. The findings from this study were in line with Gaaliche and Gaaliche (2014), where bidirectional causality was confirmed. In a separate study, Hatemi-j and Uddin (2014) investigated the causal relationship between remittance and poverty in Bangladesh and found the same results as Gaaliche and Gaaliche (2014) and Abdunnasser and Salah (2014). Sanchez-Loor and Zambrano-Monserrate (2015) investigated causality between remittance and poverty in Colombia, Ecuador and Mexico using data from 1980-2012. A bidirectional causal relationship was found in Colombia between remittance and poverty, a unidirectional causality was confirmed in Mexico and no causality was found in the case of Ecuador.

Based on the findings of the studies that investigated the causal relationship between remittance and poverty, it can be concluded that the results are inconclusive. The inconclusive results can be attributed to different methodologies, time, domain and poverty proxy employed. This makes generalisation of the results inappropriate; another empirical investigation will give an insight into the nature of the relationship between remittance and poverty in Botswana.

3 Techniques and Empirical Results

3.1 Model Specification

In this study, the ARDL-bounds test for cointegration and the ECM-based causality test are used. This approach has been selected because of numerous advantages that include: (i) the ARDL-bounds test can be used even when series have a different order of integration (Pesaran *et al.*, 2001: 290; Solarin and Shahbaz, 2013; Nkoro and Uko, 2016); (ii) the ARDL approach uses a reduced form single equation, while other conventional cointegration methods employ a system of equations (Pesaran and Shin, 1999); and (iii) ARDL provides unbiased estimates of the long-run model, even in cases where some variables are endogenous (see Odhiambo, 2009). Given these advantages, the ARDL-bounds testing approach to cointegration was selected. The null hypothesis of no cointegration was tested against the alternative hypothesis of cointegration. The calculated F-statistic was compared to the critical values provided by Pesaran *et al.* (2001). If the calculated F-statistic falls above the critical value, the null hypothesis of no cointegration is rejected. Alternatively, if the F-statistic falls below the lower bound, it is concluded that there is no cointegration. If the F-statistic falls between the upper and the lower bound, the results are inconclusive.

Although a number of poverty proxies have been used in the literature, such as human development index, poverty headcount, poverty gap, GDP, life expectancy, infant mortality rate and household consumption expenditure, in this study infant mortality rate and household consumption expenditure are used as poverty proxies. The selection of these two proxies was based on the need to capture poverty in its multidimensional form (income and non-income dimensions) and unavailability of time series data to successfully analyse using the ARDL approach.

Definition of variables

This study employs household consumption expenditure (Pov1) and infant mortality rate (Pov2) as measures of poverty. Household consumption expenditure is measured as a proportion of gross domestic product (GDP) and captures income poverty. A unidirectional causal relationship from remittance to poverty implies that high inflow of remittance leads to an increase in household consumption expenditure, resulting in a fall in poverty levels. The reverse causal relationship between the two implies that low levels of household consumption expenditure trigger high inflow of remittances. Infant mortality rate is measured as the number of infant deaths per 1000 live births. In this study, infant mortality rate is used to capture health poverty. A unidirectional causal relationship from poverty to remittance implies high infant mortality rate causes more remittance inflows, while a unidirectional causality from remittance to poverty implies that high remittance inflows are associated with low poverty levels. Remittance inflows are measured as a proportion of gross domestic product.

Other variables included in the multivariate framework are real gross domestic product per capita and education. Real GDP per capita (GDPC) measures the share of national outlay

distributed to each individual making up the total population. When GDP per capita is high, it implies that the people in that country enjoy a high living standard, implying low poverty levels. Gross primary school enrolment is used as a proxy for education. Gross primary enrolment is used in this study to measure levels of human capital. Higher enrolment rates mean high human capital and consequently high chances of individuals getting better paying jobs outside the country.

The ARDL-bounds specification for Models 1 and 2 are given in Equations 1-4, where Model 1 consists of household consumption expenditure (Pov1) as a poverty proxy and GDPC and Education (EDU). Model 2 constitutes infant mortality rate (Pov2) as a proxy for poverty, GDPC and EDU.

General Cointegration Model (Pov_m, REM, GDPC and EDU)

$$\Delta Pov_{mt} = \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=0}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=0}^n \alpha_3 \Delta GDP_{t-i} + \sum_{t=0}^n \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU_{t-1} + \theta_4 GDP_{t-1} + \mu_{1t} \dots \dots \dots (1)$$

$$\Delta REM_t = \alpha_0 + \sum_{i=0}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=0}^n \alpha_3 \Delta GDP_{t-i} + \sum_{t=0}^n \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU_{t-1} + \theta_4 GDP_{t-1} + \mu_{1t} \dots \dots \dots (2)$$

$$\Delta GDP_t = \alpha_0 + \sum_{i=0}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=0}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^n \alpha_3 \Delta GDP_{t-i} + \sum_{t=0}^n \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU_{t-1} + \theta_4 GDP_{t-1} + \mu_{1t} \dots \dots \dots (3)$$

$$\Delta EDU_t = \alpha_0 + \sum_{i=0}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{i=0}^n \alpha_2 \Delta REM_{t-i} + \sum_{i=0}^n \alpha_3 \Delta GDP_{t-i} + \sum_{i=1}^n \alpha_4 \Delta EDU_{t-i} + \theta_1 Pov_{mt-1} + \theta_2 REM_{t-1} + \theta_3 EDU + \theta_4 GDP_{t-1} + \mu_{1t} \dots \dots \dots (4)$$

Where Pov_m assumes the position of Pov1 – household consumption expenditure in Model 1 when $m = 1$; and the position Pov2 – infant mortality rate in Model 2 when $m = 2$; and they enter in the equation one at a time, REM – remittance as a percentage of GDP; EDU – education, GDPC – real GDP per capita, α_0 is a constant, $\alpha_1 - \alpha_4$ and $\theta_1 - \theta_4$ are regression coefficients, and μ_{1t} is an error term.

Granger-Causality Model Specification

The presence of cointegration in any of the functions indicates a long-run relationship among the variables, at least in one direction (Narayan and Smyth, 2004). To establish the direction of causality, ECM-based causality approach is used in a multivariate framework. Multivariate causality framework has an advantage over bivariate framework which may suffer from omission of variable bias (Odhiambo, 2008). The ECM-based causality models for Model 1 and Model 2 are given in Equations 5-8. The ECM-based causality allows analysis of causality in the short run and in the long run. The short-run causality is tested using the F-statistic obtained from the variable deletion test, while the long run is obtained from the t-statistic on the lagged error correction term.

The General ECM-based Granger-causality model specifications are given in Equations 5-8.

$$\begin{aligned}
Pov_{mt} = & \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^n \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^n \alpha_4 \Delta GDP_{t-i} \\
& + \theta_1 ECM_{t-1} + \mu_{1t} \dots \dots \dots (5)
\end{aligned}$$

$$\begin{aligned}
REM_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^n \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^n \alpha_4 \Delta GDP_{t-i} \\
& + \theta_1 ECM_{t-1} + \mu_{2t} \dots \dots \dots (6)
\end{aligned}$$

$$\begin{aligned}
GDP_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^n \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^n \alpha_4 \Delta GDP_{t-i} \\
& + \theta_1 ECM_{t-1} + \mu_{3t} \dots \dots \dots (7)
\end{aligned}$$

$$\begin{aligned}
EDU_t = & \alpha_0 + \sum_{i=1}^n \alpha_1 \Delta Pov_{mt-i} + \sum_{t=1}^n \alpha_2 \Delta REM_{t-i} + \sum_{t=1}^n \alpha_3 \Delta EDU_{t-i} + \sum_{t=1}^n \alpha_4 \Delta GDP_{t-i} \\
& + \theta_1 ECM_{t-1} + \mu_{4t} \dots \dots \dots (8)
\end{aligned}$$

Where α_0 is a constant, $\alpha_1 - \alpha_4$ and θ_1 are regression coefficients, $\mu_{1t} - \mu_{4t}$ are the error terms and all the other variables are as described in Equations 1-4.

Data Sources

Time series data was employed in this study covering the years from 1980 to 2017 to investigate the causal relationship between remittance and poverty. Remittance data was extracted from the United Nations Conference on Trade and Development (UNCTAD) database. The rest of the data – poverty proxies – household consumption expenditure and infant mortality rate, gross domestic product per capita (GDPC) and education were extracted from the World Bank Development Indicators. Microfit 5.0 was used to analyse the data.

3.2 Empirical Results

Unit Root Test

Although the ARDL bound test approach does not require pretesting of variables for unit roots, unit roots tests were done on remittance (REM), household consumption expenditure (HHC), infant mortality rate (INFA), real gross domestic product per capita (GDPC), education (EDU). The tests were done to ascertain if all variables have the highest integration order of one [I (1)], that is acceptable for the utilisation of the ARDL approach (Pesaran *et al.*, 2001). Table 2 presents unit root results on Dickey-Fuller Generalised Least Square (DF-GLS), Perron unit root test (PP root), and Perron unit root test (PPU root test)

Table 1: Unit Root Test Results

Dickey-Fuller Generalised Least Square (DF-GLS)												
Dickey-Fuller Generalised Least Square (DF-GLS)					PP (root) Test				PPU(root) Test			
Variable	Stationarity of all Variables in Levels		Stationarity of all variables in First Difference		Stationarity of all Variables in Levels		Stationarity of all variables in First Difference		Stationarity of all Variables in Levels		Stationarity of all variables in First Difference	
	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend
Pov1	-4.7992***	-2.1125	-	-5.4253***	-2.3701	-2.3230	-8.7848***	-5.7903***	-3.0025	-3.9195	-6.6084***	-6.3298***
Pov2	-2.3094	-3.3981*	-8.8734***	-	-2.2318	-3.5114*	-8.7848***	-	-4.0837	-4.0811	-9.5025***	-9.8399***
REM	-0.2259	-1.7454	-1.8385*	-3.5280**	-4.1699***	-3.5174*	-	-	-4.6218	-4.0459	-7.5698***	-9.6037***
GDPG	-0.5747	-2.1439	-6.3333***	-6.2498***	-0.5553	-3.2360**	-7.5580***	-	-3.4699	-3.9018	-7.0933***	-7.1587***
EDU	-0.9543	-1.4020	-3.7208***	5.6913***	-4.0929***	-2.4635	-	-5.9006***	-2.8468	-3.1261	-7.0933***	-7.1587***

Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively

The results of the unit root test presented in Table 1 confirm that all the variables in the model are stationary either in levels or in first difference. The next step is a test for cointegration among the functions that include Pov1 and Pov2. The variables included in the cointegration function are Pov1, REM, GDPC and EDU for Model 1 and Pov2, REM, GDPC and EDU for Model 2. The cointegration results are presented in Table 2.

Table 2: ARDL Bound Test to Cointegration Results for Model 1 and 2

Dependent Variable	Function		F-Statistic		Cointegration Status	
Panel A: Model 1						
Pov1	F(Pov1 REM, GDPC,EDU)		3.7745*		Cointegrated	
REM	F(REM Pov1,EDU, GDPC)		5.3461***		Cointegrated	
GDPC	F(GDPC Pov1,REM, EDU)		0.7397		Not Cointegrated	
EDU	F(EDU Pov1, REM, GDPC)		1.5134		Not Cointegrated	
Panel B: Model 2						
Pov2	F(Pov2 REM, EDU, GDPC)		1.1505		Not Cointegrated	
REM	F(REM Pov2,GDPC, EDU)		6.2390***		Cointegrated	
GDPC	F(GDPC Pov2, REM, EDU)		0.5333		Not Cointegrated	
EDU	F(EDU Pov2, REM, GDPC)		2.3438		Not Cointegrated	
Asymptotic Critical Values (unrestricted intercept and no trend)						
Pesaran <i>et al.</i> (2001:300) critical values(Table CI(iii) Case III	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	4.29	5.61	3.23	4.35	2.72	3.77

Note:*, ** and *** denote stationarity at 10%, 5% and 1 % significance levels, respectively.

The calculated F-statistics are compared to critical values provided by Pesaran *et al.* (2001); critical values are also provided in Table 2. Cointegration is confirmed if the calculated F-statistics is greater than the upper bound, while no cointegration is confirmed if the calculated F-statistics is

below the lower bound. In the case where the F-statistic falls between the lower and the upper bound, the test is inconclusive (Pesaran *et al.*, 2001). Results presented in Table 2 confirm cointegration in Pov1 and REM functions in Model 1, while in Model 2 cointegration is recorded for the REM function. According to Narayan and Smyth (2008), the presence of cointegration shows causality in at least one direction. To determine causal relationship among the variables in each function, the ECM-based causality test is employed. The functions where cointegration is confirmed, a lagged error correction term is added into the functions, and for those functions where no cointegration is confirmed, causality is tested among the variables in the function, without the inclusion of the ECM. The results of the ECM-based causality test are reported in Table 3.

Table 3: ECM-Based Causality Results

	Panel A : Model 1				
Dependent Variable	F-Statistics [Probability]				ECM
	Δ Pov1	Δ REM	Δ GDPC	Δ EDU	t-statistics
Δ Pov1	-	6.3474***[0.017]	0.4082[0.528]	4.1294**[0.051]	-0.4298***[-0.024]
Δ REM	3.0804*[0.091]	-	0.5960[0.447]	1.3708[0.253]	- 0.2971***[0.003]
Δ GDPC	0.2137[0.647]	3.7604*[0.062]	-	7.6308***[0.010]	-
Δ EDU	4.9392***[0.034]	6.1434***[0.019]	5.3137***[0.028]	-	-
	Panel B: Mode1 2				
Dependent Variable	F-Statistics				ECM
	Δ Pov2	Δ REM	Δ GDPC	Δ EDU	t-statistics
Δ Pov2	-	0.7398[0.397]	3.4818*[0.072]	0.5940[0.449]	-
Δ REM	5.8243***[0.023]	-	0.2591[0.615]	0.4076[0.529]	-0.7160***[0.001]
Δ GDPC	1.4969[0.230]	3.7776*[0.061]	-	5.2103***[0.029]	-
Δ EDU	2.9290*[0.090]	0.1752[0.679]	6.4179***[0.017]	-	-

Note:*, ** and *** denote stationarity at 10%, 5% and 1% significance levels, respectively.

The results presented in Table 3 confirm a bidirectional causal relationship between Pov1 (household consumption expenditure) and remittance in the short run and in the long run. This confirms the altruism motive that people who migrate to other countries feel obliged to help their relatives back home (Depoo, 2014:203). According to Adam Jr and Page (2005) and Ratha (2013), remittances are used for consumption and investment – human capital, small businesses and other cash assets, confirming the positive impact that remittance has on poverty reduction.

When poverty is measured by infant mortality rate, a unidirectional causal relationship is confirmed, from Pov2 (infant mortality rate) to remittance in the short run and in the long run. This is confirmed by the F-statistics of ΔPov2 , which is significant at 5% in the REM function. This finding suggests that high poverty levels cause emigrants to remit more resources back home. The cause for remitting can range from coinsurance, altruism and savings, according to Lucas and Stark (1985).

There is also an indirect causal flow from remittance to poverty, through gross domestic product per capita, in the short run. This relationship is supported by a unidirectional causal flow from remittance to GDPC in the short run; and a unidirectional causal flow from GDPC to Pov2 in the short run. Thus, the indirect causality from remittance to infant mortality rate, through GDPC, confirms the indirect causal effect of remittance on poverty that can be realised through the multiplier effect, according to Ratha (2007).

Other empirical results presented in Table 3 Panel A reveal that in Botswana there is: (i) no causal relationship between Pov1 (household consumption expenditure) and remittance both in the short

run and in the long run; (ii) there is a unidirectional causality from remittance to GDPC in the short run. This can be realised through the current account where more receipts are recorded; (iii) bidirectional causality between GDPC and education in the short run; (iv) bidirectional causality between Pov1 and education in the short run and a unidirectional causal relationship from education to Pov1 in the long run; and (v) unidirectional causal relationship from remittance to education in the short run.

Empirical results presented in Table 3, Panel B reveal that in Botswana there is: (i) unidirectional causality from remittance to GDPC in the short run; (ii) unidirectional causality from GDPC to Pov2 (infant mortality rate) in the short run; (iii) a bidirectional causality between GDPC and education in the short run; (iv) no causal relationship is registered between remittance and education in the long run and the short run; and (v) unidirectional causality from Pov2 (infant mortality rate) to education in the short run. A summary of the Granger-causality results is given in Table 4.

Table 4: Summary of Granger-Causality Results

	Causality		
	SR – Direct	LR - Direct	SR - Indirect
Model 1 (Pov1)	Pov1↔REM	Pov1↔REM	Pov1≠REM
Model 2 (Pov2)	Pov2→REM	Pov2→REM	REM→GDPC→Pov2

Notes: Pov1= household consumption expenditure; Pov2 = infant mortality rate

5. Conclusion and Recommendation

In this study, the causal relationship between remittance inflows and poverty in Botswana is investigated using time series data from 1980 to 2017. The study was motivated by the need to find a variable that government can influence to realise poverty reduction. The ECM-based Granger-causality model was employed to explore the nature of the relationship obtaining in Botswana. A multivariate framework was adopted in the study to avoid omission of variable bias that may occur in a bivariate framework. Apart from poverty proxies (Pov1 – household consumption expenditure and, Pov2 – infant mortality rate) and remittance, gross domestic product per capita and education are included in the model, forming a multivariate Granger-causality model. Two poverty proxies were selected to capture poverty in its multidimensional – income and non-income poverty. In addition, the two proxies were also selected to improve the robustness of the results. The results from the study show that when household consumption expenditure is used as a proxy a bidirectional causal relationship in the short run and in the long run is confirmed. However, when infant mortality rate is used as a proxy for poverty reduction, poverty is found to Granger-cause remittance in the short run and in the long run. The study found infant mortality rate (Pov2) to indirectly Granger-cause remittance in the short run through Gross Domestic Product. The study, therefore, concludes that the causal relationship between remittances and poverty in Botswana is sensitive to poverty proxy used to measure the level of poverty. On the whole, the results confirm a significant role that remittance inflows play in reducing poverty in Botswana, either directly or indirectly. Based on these findings, it is recommended that Botswana may reduce poverty through putting in place policies that support migration and establish channels that make remittance easy and less costly.

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